LETTERS TO THE EDITOR.

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Polarisation of Light Scattered by Helium Atoms.

ABOUT a year and a half ago I published an experimental investigation of the *degree of polarisation* in the light scattered at right angles by various dust-free gases (Proc. Roy. Soc., A, vol. xcv., p. 155). I believe the results then obtained to be in the main quite correct, but there is an important point on which I have completely to withdraw what I then said. This refers to the results on helium, which was then found to behave differently from the other gases, giving much less complete polarisation than any of them. The result given was that the weak image (vibrations parallel to incident beam) had 42 per cent. of the intensity of the strong image (perpendicular vibrations). This was given on the results of two independent series of photographs, which were, indeed, obtained under conditions much more difficult than those for the common gases, but were considered at the time to give adequate evidence. I do not even now know what was wrong with them; but on repeating the work with a much improved apparatus, which it has taken many months to design and construct, I have obtained an entirely different, I might say opposite, result.

I now find no intensity large enough to be observed in the weak image, and certainly not 3 per cent. of the intensity in the strong image. It may be possible to lower this limit still further; but, in any case, if helium is outstanding at all, it is in the direction of polarising more, and not less, completely than the generality of gases. The details will be published later, but I write to make the correction as soon as possible, so that no one who speculates theoretically on the subject may be misled by reliance on my former result.

RAYLEIGH.

December 21.

Gravitation and Light.

IT should perhaps be stated, in connection with Mr. Cunningham's remarks (NATURE, December 18, p. 395), that my difficulty with regard to Dr. Einstein's theory must extend to the deviation of light by the sun as well as to its change of period. According to the theory, the velocity of light *diminishes* near the sun; on the other hand, the scale of time is increased, so that the wave-length is not altered. Now, the space being nearly flat, the path of a ray is, with such heterogeneous time, determined fundamentally by minimum number of waves, and not by minimum time; therefore, it should not be altered.

On the other hand, passing from kinematics to dynamics, Dr. Einstein requires in another connection that light should consist of discrete bundles or *quanta* of energy. Let it also be granted that inertia and gravitation are attributes of all energy. It seems to follow that each of these bundles of energy will swing round the sun in a hyperbolic orbit, and that its velocity will be *increased* when near the sun. It is well known that this would account for half the observed deflection. But, again, physical optics could not exist without the idea of transverse waves and their phases, which must be grafted on somehow to the bundles of energy. Now the supposed gravitational derangement of the fourfold extension from the flat being very slight, it can be agreed that the change in extent of each element of it is of the second order. The expansion of scale of time near the sun requires thus a compensating shrinkage of radial lengths; and this second-order effect, the cause of the adjustment for Mercury, will, on the phase-principle of Huygens, just double the previous result. This would amount in all to the observed deflection of the rays.

But amid these uncertainties and apparent contradictions the view asserts itself that the very important astronomical determination is to be regarded as a guide towards future theory rather than as the verification of the particular theory which suggested it.

JOSEPH LARMOR.

Cambridge, December 20.

Radio-activity and Gravitation.

IN connection with the interesting letter of Prof. Donnan in NATURE of December 18, it may be of interest to mention some experimental results which have a bearing on this question. Some years ago Dr. Schuster suggested to one of us that it would be of interest to test whether the rate of transformation of radio-active substances was influenced by the intensity of gravitation. An accurate method of testing the rate of decay of radium emanation over a period of about a hundred days was developed, and it was intended to compare the rate of decay of samples which had been transported to suitable portions of the earth's surface. The outbreak of the war interfered with this plan.

Since, according to Einstein's theory, a gravitational acceleration is in no sense different from a centrifugal acceleration, experiments have been performed in the Cavendish Laboratory to test whether the rate of decay of radio-active substances is affected by subjecting them to the high centrifugal acceleration at the edge of a spinning disc. For the purpose of measurement the γ-ray activity was determined by a sensitive-balance method. Although the radio-active material was subjected to an acceleration of more than 20,000 times gravity, the change observed, if any, was certainly less than one part in a thousand.

This result is not in disaccord with the relation deduced by Prof. Donnan, for a simple calculation shows that his relation predicts an effect very much smaller than can be detected by measurements of this character.

E. RUTHERFORD.
A. H. COMPTON.

Cavendish Laboratory, December 19.

Mortality among Snails and the Appearance of Blue-bottle Flies.

THE residential parts of Calcutta are remarkably free, as a rule, from both house-flies (Musca, spp.) and blue-bottles. This is doubtless due to the excellence of the municipal sanitary arrangements, for at Sibpur, a few miles away, blue-bottles (*Pycnonoma* or *Lucilia dux*) are not only extremely troublesome in the houses, but are also probably connected with frequent epidemics of enteric, unknown in the better parts of Calcutta. For some years past I have noticed in the compound of the Indian Museum that Pycnonoma from time to time becomes relatively numerous, and on several occasions I have been able to trace the flies to their breeding-ground. This has always been the dead bodies of the snail *Achatina fulica*, the largest land mollusc in Bengal.

A. fulica, the shell of which may attain a length of at least 4 in., is not an indigenous species, but was introduced for purposes of dissection by a keen

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malacologist some sixty-five years ago from Mauritius, whither it had been brought in some unknown manner from tropical Africa, its original home. Col. Godwin Austen[1] has told the story of its introduction into Calcutta, while Mr. E. E. Green[2] has published a report on its prodigious increase in Ceylon, when once its eggs had been carried (accidentally on a cabbage-leaf) into a suitable locality. Fortunately, it is largely a feeder on decaying vegetable and animal matter, and therefore does little harm to crops or gardens, and has even its value as a scavenger. Since, however, I found the maggots in the dead snails, I have noticed that the appearance of blue-bottles in this part of Calcutta invariably coincides with a heavy mortality in the mollusc, which appears to be subject occasionally to some kind of fatal epidemic and also perishes in large numbers after egg-laying at the beginning of the rainy season and during dry spells in and at the end of that season. In one instance investigated the mortality was due not to disease or weakness or to meteorological conditions, but merely to the fact that the snail was enormously abundant and that large numbers of individuals were crushed by people walking on garden paths in the evening.

I have thought these facts worth putting on record as illustrating the delicate balance of Nature and the danger of introducing apparently harmless or even seemingly beneficial animals into a new country.

N. ANNANDALE.

Indian Museum, Calcutta, November 19.

Remains of a Fossil Lion in Ipswich.

IN 1910 I discovered a rich bone-bed in a section of Stoke Hill at Ipswich, the deposit in which it occurred being 30 ft. below the surface. The results of the researches then undertaken were published in vol. xiv., part 1, of the Proceedings of the Suffolk Institute of Archæology and Natural History.

As a portion of Stoke Hill is now being cut away for railway sidings, a continuation of the same section is exposed, and with the permission and kind assistance of Mr. A. Woolford, G.E. Railway District Mechanical Engineer, I have been able to work for the past month upon it.

To the animal remains found in 1910, which included large cave-bear, mammoth, large horse, *Bos primigenius*, smaller ox, deer, and bird, I have now added teeth of the largest cave-lion yet discovered, with the exception of the Crayford specimen in the Spurrell collection. These were identified for me by Dr. Smith Woodward and Dr. Andrews, who also examined and named a large assortment of teeth and bones from the site. The list of remains is daily being added to, and a massive skull of deer, with other bones, a tooth, and an antler with a base measuring 10 in. in circumference, still await identification. The position of the tines suggests reindeer. With the help of a grant from the Percy Sladen Research Fund, I am able to continue the work with the care that it requires, and am employing special workmen for the purpose.

The question of the relation of Glacial deposits to these ancient land-surfaces is, of course, of paramount importance, especially as a small number of worked flints have been found closely associated with the animal remains. For this purpose pits are being dug to a considerable depth below our present ground-level in order to ascertain the constituents of the strata below.

NINA F. LAYARD.

Rookwood, Ipswich, December 17.

Promotion of a Plumage Bill.

MAY I announce through the columns of NATURE the formation of a "Plumage Bill Group," designed to fight the plumage trade by means of publicity to the facts and of pressure upon the Government to bring in a Bill forbidding the importation of all birds' skins for millinery purposes, except poultry, ostrich, and eider-duck? Sir Charles Hobhouse is the president of this group; Lt.-Col. Swinburne, of 23 Eaton Place, S.W.1, its treasurer; and Mr. W. Dewar, of 8 Kenilworth Court, Putney, S.W.15, its hon. secretary. The group is in need both of funds and of assistance, and the former will be very gratefully received by the treasurer, and the latter as gratefully considered by the secretary and the committee.

We feel that a vigorous effort must be made to end the yearly massacre of the world's most beautiful and interesting species of wild bird—a massacre so merciless and extensive as seriously to threaten the extermination of a large number of species, and thus to throw out of gear the great work of evolution. Nor is there any honest or valid argument for the traffic, since this immense drain upon natural resources is for no other purpose than to feed the profits of a small band of East End traders and to satisfy the frivolity of some women.

H. J. MASSINGHAM.

December 17.

The Deflection of Light during a Solar Eclipse.

THERE can scarcely be a downward rush of cold air in places deprived of the sun's radiation during an eclipse as suggested by Prof. Anderson. This would happen only if the upper layers of the atmosphere were cooled more than the lower, and if the cooling were sufficient to bring the temperature-gradient near to the adiabatic. As it is, however, the effect of an eclipse should be to cool the lower layers more than the upper, and so to decrease the temperature-gradient. Moreover, if cooling caused convection movements, we should have upward currents as well as downward, and a development of cumulus clouds would result from the passage of the moon's shadow.

C. J. P. CAVE.

Ditcham Park, Petersfield, December 19.

INDUSTRIAL RESOURCES OF INDIA.[1]

AS explained in a preface by Sir Thomas H. Holland, the president of the Indian Munitions Board, this handbook was originally prepared in connection with the exhibit of the Board at the exhibitions held in Bombay and Madras in the winter of 1917–18. It was intended to show what had been done to develop India's industrial resources for war purposes. It has now been enlarged so as, in some measure, to indicate the general industrial development which has taken place during, and on account of, the war, and it discusses the possibility of future progress.

The Board was created in 1917 with the view of relieving the United Kingdom, so far as possible, from the necessity of meeting India's demands for war purposes, and particularly for the supply of the forces in India, Mesopotamia, and Egypt. Its functions consisted not only in utilising Indian resources to the utmost extent, but also in controlling and regulating imported

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[1] Proc. Mal. Soc., vol. viii., p. 147 (1908).

[2] "Report on the Outbreak of *Achatina fulica*" in Circulars and Agricultural Journal of the Royal Botanical Gardens, Ceylon (1910).

[1] Indian Munitions Board. Industrial Handbook, 1919. Revised Edition. (Calcutta: Superintendent, Government Printing, 1919.) Price *2s. 3d.*

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